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FOREST INDUSTRIES IN THE BLACK HILLS AREA, SOUTH DAKOTA AND WYOMING

by

E. F. Landt, Technologist[1]

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CONTENTS

Page

Introduction 1

Sawmill industry 1

  Kinds of mills 1
  Production and capacity 4
  Logging 6
  Residues 7

Post and pole industry 8

Pulpwood industry 10

Summary and conclusions 12

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[1] Central headquarters for the Rocky Mountain Forest and Range Experiment Station, Forest Service, U. S. Department of Agriculture, is maintained at Fort Collins in cooperation with Colorado State University; research reported here was conducted by the station's field unit at Rapid City in cooperation with the South Dakota School of Mines and Technology.

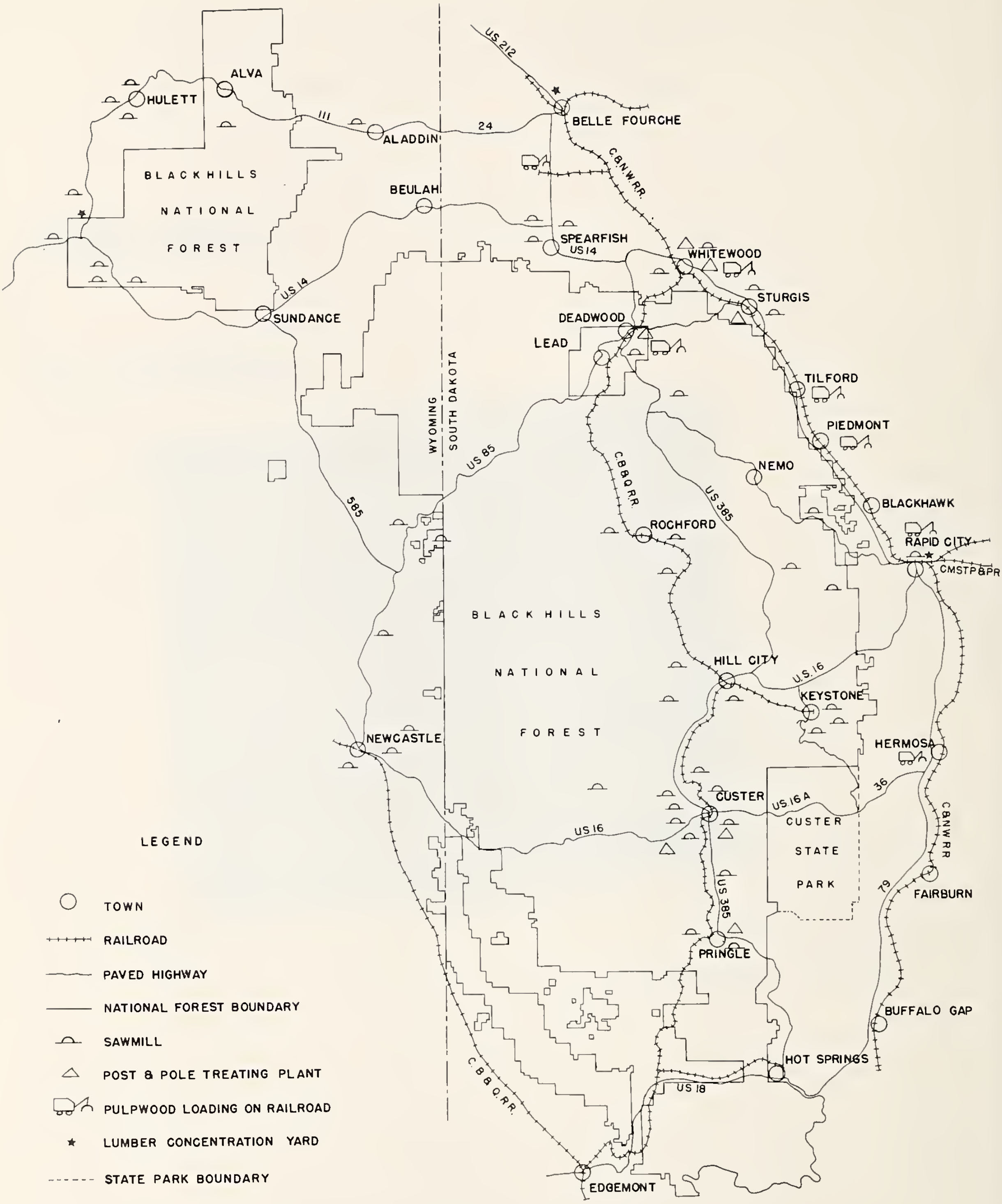

Figure 1.--Location of forest industries in the Black Hills.

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INTRODUCTION

Forest industries in the Black Hills area, which here includes the adjacent Bear Lodge Mountain area in Wyoming (fig. 1), began in the 1870's. From that time to the present these industries have contributed materially to the local economy. Present timber-sale policies of Federal, State, and many private landowners is to cut no more than can be grown and thus assure a permanent forest reserve.[2] Therefore, these industries will continue to contribute to the future economy.

Forest industries, like most other industries, are undergoing continuous change in their methods of operation and in kind of products produced. The purpose of this report is to describe the present characteristics, operations, and products of the forest industries and to relate their activities to the available resources.

SAWMILL INDUSTRY

KINDS OF MILLS

There are four types of sawmills in the area (table 1). Out of a total of 50 mills, 43 have circular head saws (fig. 2). An additional four mills have

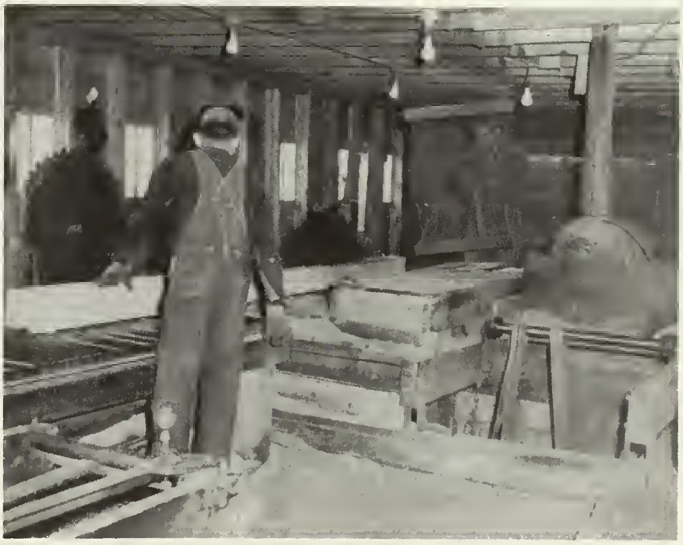

Figure 2. -- Conventional circular head saw.

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[2] Newport, Carl A. Forest Service policies as they affect the lumber industry: A case study of the Black Hills. Jour. Forestry 54: 17-20. 1956.

Table 1. --Lumber production by kind of sawmill, 1958[1]

Kind of sawmill	Number	Lumber production		Capacity		Ratio of production to capacity
		M b.m.	Percent	M b.m.	Percent	Percent
Circular head saw and no resaw	43	42,593	50	71,250	55	60
Circular head saw and cant sash gang resaw	4	12,025	14	22,800	18	53
Circular head saw and horizontal band resaw	2	13,357	16	17,100	13	78
Band head saw and horizontal band resaw	1	17,500	20	17,700	14	99
Total	50	85,475	100	128,850	100	66

[1] Total lumber production in 1959 was more than 15 percent greater than the production in 1958, or a total of 98,695 M b.m. lumber tally.

circular head saws followed by cant sash gangsaws (fig. 3A). Here, the circular head saw can be used to cut lumber, but its primary purpose is to cut two- or four-sided cants for the gangsaws, which are faster and have thinner blades. Two other mills have circular head saws followed by horizontal band resaws (fig. 3B). Here, too, the head saw can produce lumber, but its primary purpose is to cut whole logs into cants for the resaw. One mill has a band head saw followed by a horizontal band resaw. Most of the mills bring logs into the mill on rollways; however, three mills have log ponds (fig. 4).

One modern mill with a circular head saw, a horizontal band resaw, and a log pond was built since 1956.[3/] Until 1956 there were no gangsaws in the area. Between 1956 and 1959, four sawmills installed cant sash gang resaws. As a general rule, the conventional mills with circular saws but without resaws are slower and waste more wood in the form of sawdust.

During the same period three sawmills installed live log decks and pushbutton carriages on the head saws. This reduced the sawing time on the head rig and eliminated at least one log deck man and sometimes the carriage man. Faster handling of logs permitted the mills to increase their production with fewer men.

3/ This sawmill was destroyed by fire in 1960 and was not rebuilt.

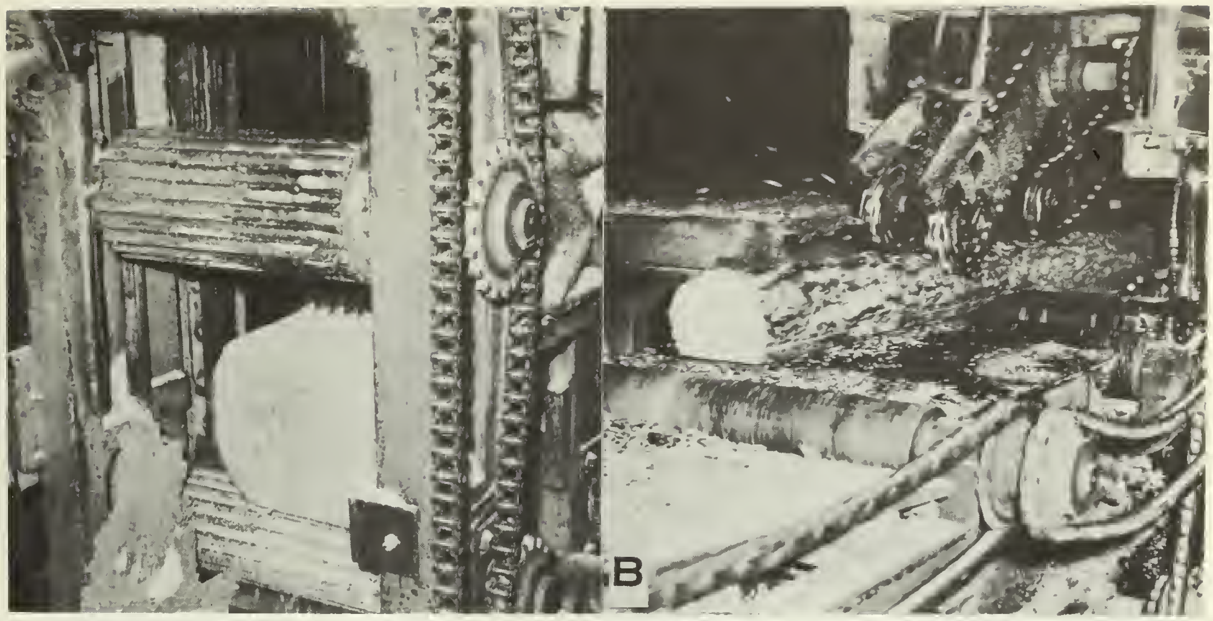

Figure 3. --Types of resaws used by Black Hills sawmills. A, Cant sash gang resaw; B, horizontal band resaw.

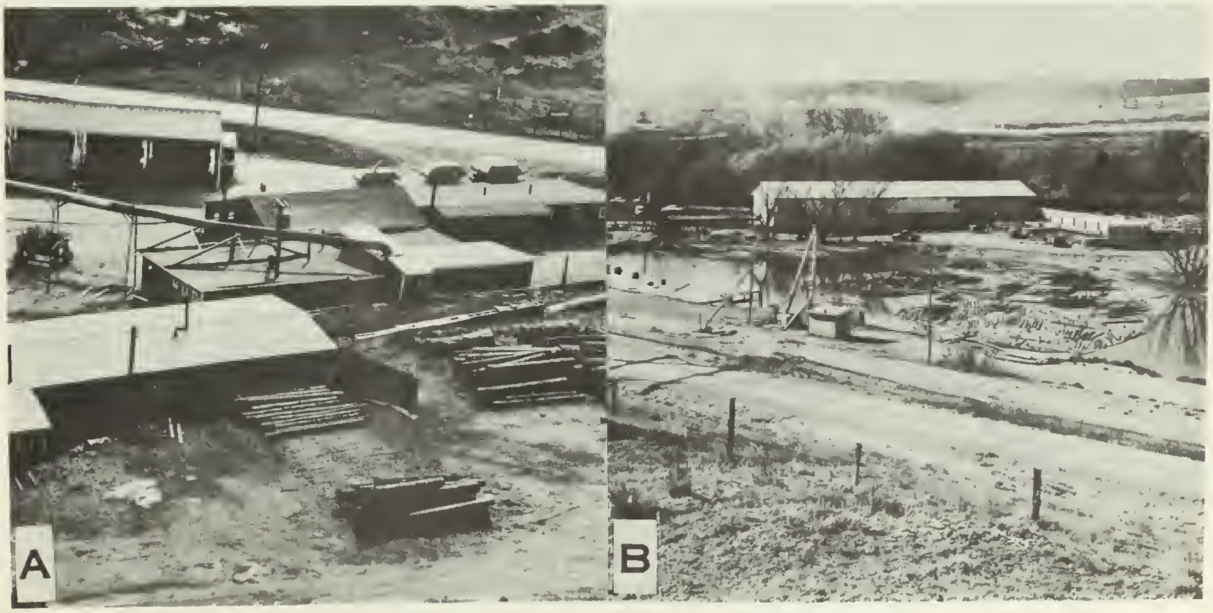

Figure 4. --Methods of handling logs at Black Hills sawmills. A, Log rollway in foreground from which logs are rolled into the mill; B, log pond from which logs are floated to the mill.

All sawmills equipped with resaws produce seasoned and surfaced 4/4 lumber. In addition one mill saws large quantities of mine timbers and dimension material. In contrast, several of the circular type produce only rough green 4/4 lumber and dimension material. Eight of the 50 mills season all or part of their lumber in dry kilns (fig. 5A). Air seasoning is used at the other mills (fig. 5B).

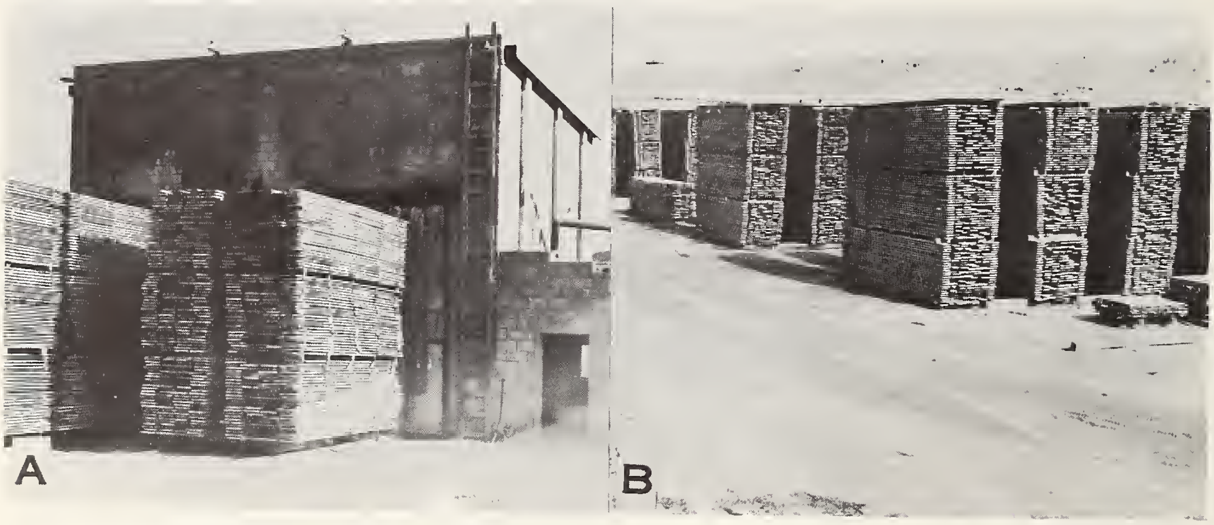

Figure 5. --Methods of seasoning ponderosa pine lumber in the Black Hills. A, Modern dry kiln of about 30 M b. m. capacity; B, a well maintained air-drying yard.

The mills with resaws and most of those with circular saws are permanent and located in or near towns (see fig. 1). Permanent mills usually operate yearlong. This is especially true of the resaw-type mill. A few of the circular mills move occasionally and operate only part time during the year. The operators of part-time mills have other sources of income and usually have no desire to run full time. Also, these operators may not have the finances to purchase enough timber to operate full time.

PRODUCTION AND CAPACITY

The rated lumber-production capacity of the 50 sawmills in the area is about 129 million board feet (lumber tally) annually (table 1). This is the amount that could be cut by the existing mills without additional improvements or manpower if they operated at full capacity all the time. This is rarely the case however, as the results of this study show. The lumber production of the mills in 1958 was about 85 million board feet lumber tally. Only one mill cut more than 10 million board feet a year. The remaining mills cut less than 10 million, with most of them cutting less than 5 million a year. The 1958 production rate was about two-thirds of the capacity of the mills. However, between July 1, 1958 and July 1, 1959, the mills increased their production by more than 15 percent. This was one of the few periods in the history of the Black Hills sawmill industry that the allowable amount was cut on national-forest lands. During the past 36-year period the sawmills cut on the average about 67 percent of the available supply on Federal lands. The 1959 lumber production was at an alltime high for the Black Hills sawmills. This record lumber production demonstrated that under the circumstances the mills have the capacity to cut all the available sawtimber. However, in view of the many years they failed to meet the quota it would be premature to conclude from this that the present sawmill capacity is adequate. More than likely it is not, especially since future allowable cut volumes are very apt to be revised upward. The opportunity for additonal sawmill capacity appears best in the northern part of the Black Hills.

Various amounts and kinds of lumber are produced by the different types of mills. One-half of the total production was cut by seven sawmills having resaws. The remaining one-half was cut by 43 conventional circular mills with no resaws. Sixty percent of the lumber produced was dried and surfaced at the sawmills. About 13 percent was dried and surfaced at concentration yards or lumber yards. The remaining 27 percent was sold rough green at the sawmills. About 80 percent of the lumber produced was 4/4 (1-inch) lumber. The remaining 20 percent was cut into dimension and mine timbers. Ninety percent of the 4/4 lumber was in the common grades.[4]

The lumber produced in the Black Hills is marketed both locally and in several of the surrounding and midwestern states. Generally, most of the 4/4 lumber is marketed at retail lumber yards. It is used for roof boards, sheathing, and subfloors (fig. 6A). Ponderosa pine is also marketed as molding and used extensively for interior trim in houses (fig. 6B). Other markets for Black Hills ponderosa pine lumber include edge-glued lumber, toys, laminated door jams, cores for flush doors, and small clear-cut-stock items.

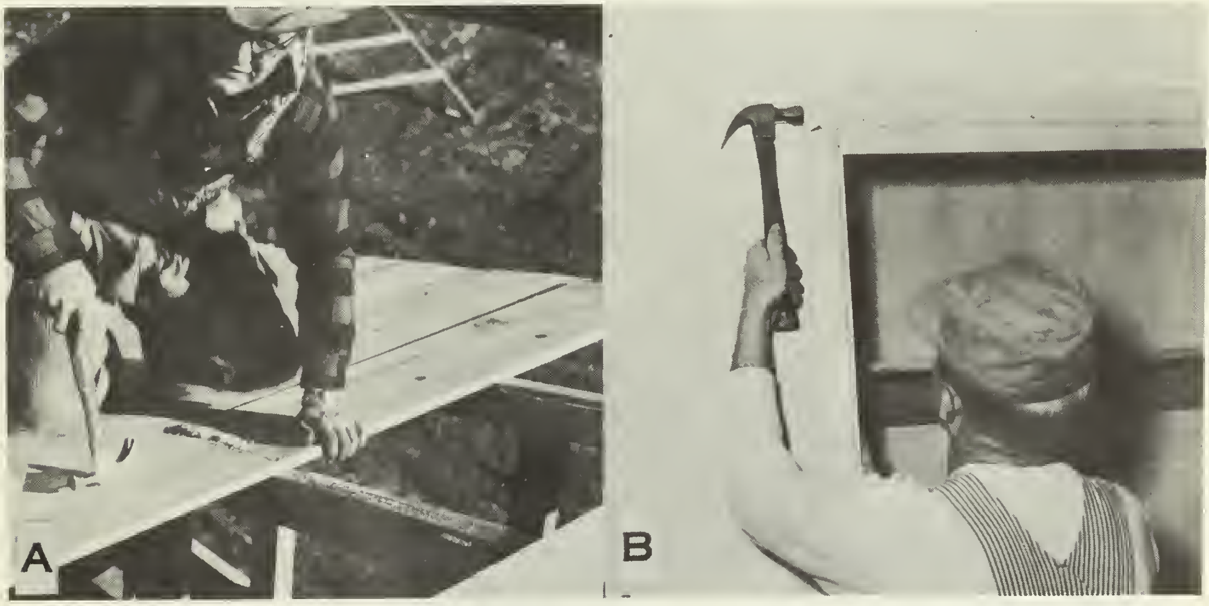

Figure 6.--Uses for Black Hills ponderosa pine. A, Roof boards on a new house; B, molding for interior trim in a new house.

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[4] Landt, E. F., and Woodfin, R. O., Jr. Amounts and grades of lumber from Black Hills ponderosa pine logs. U. S. Forest Serv., Rocky Mountain Forest and Range Expt. Sta. Sta. Paper 42, 24 pp., illus. 1959. [Processed.]

LOGGING

National-forest, private, and State lands all furnish logs to the sawmills. National-forest lands furnish 74 percent of the logs. Private lands in South Dakota and Wyoming together furnish about 20 percent, although such lands in Wyoming furnish a greater proportion. State lands furnish about 6 percent of the logs. Logging on national-forest, State, and on some private lands is on a sustained-yield basis. This means that these lands will be capable of permanently furnishing logs to the sawmills of the area.

Log size, volume cut per acre, and size of sales in the Black Hills are about average for the central Rocky Mountain region. The logs average about 11 inches in diameter and run between 14 and 20 per thousand board feet. On lands managed for sustained yield, average volume of timber cut per acre is about 1,800 board feet. However, as much as 4,000 board feet or as little as 800 board feet per acre may be cut. National-forest timber sales range from a few hundred board feet to about 20 million board feet. However, the average size of sales is about 1-1/2 million board feet. This amount can be handled by most of the mills of the area.

Logging is possible year round in most parts of the area. Weather seldom hampers logging except for a short time during the spring thaws. Some of the mills stockpile logs to carry them through this period and when load restrictions are on the roads. During the winter months, logs are easily taken out of the woods. However, these winter-cut logs are frozen and cause some trouble in sawing. Most of the logs are cut and hauled by contract or "gypos"; however, some mills have their own logging and trucking crews.

Logging methods have not changed in the past several years. Skidding is done by either horse or tractor. Usually loading is by a power jammer. Log hauling is by truck (fig. 7). Occasionally, tractors are used to skid tree-lengths, which are bucked at the loading deck. However, most logs are brought in to the mills in the standard log lengths of 8, 10, 12, 14, and 16 feet. About 75 percent of the logs are cut into 16-foot lengths.

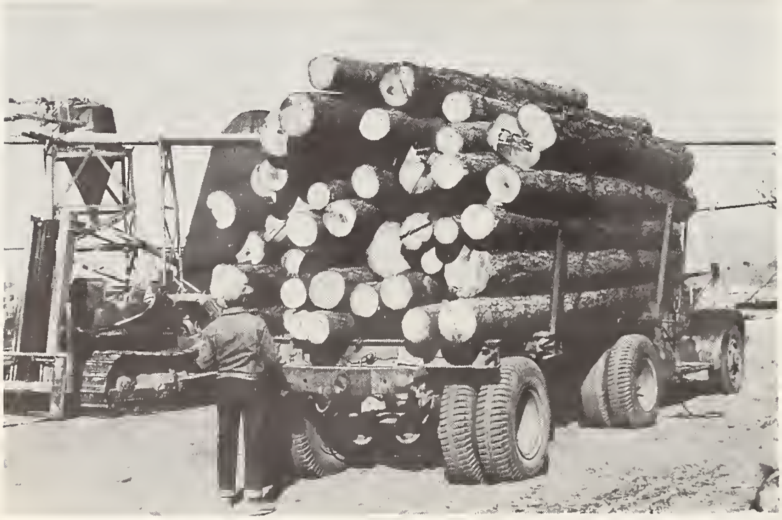

Figure 7. -- A truckload of Black Hills ponderosa pine saw logs at the mill.

RESIDUES

Sawmills produce large quantities of bark, slabs, edgings, trim, shavings, and sawdust. An accurate estimate of the amount of these residues is not currently available. Probably the total volume each year is about 196,000 tons ovendry. Chippable residues (slabs and edgings) total about 57,000 tons. Approximately 90 percent of the residues are unused because of the lack of markets.

A study of the amount of logging residues is underway. Field work has been completed and the results will be made available in a later publication.

Small amounts of mill residues are being used in various ways. For example, nine mills in the Black Hills produce about 63,000 bundles of lath (50 lath per bundle) a year from slabs and edgings. Lath is used primarily for grade stakes and snow fencing. Sawmills use the trim from lumber and short lengths of boards for producing cut-stock and box shook. Cut-stock can be used for cores in flush doors, toys, and small parts for furniture. Shavings and sawdust are burned for steam. One plant in the area is baling shavings for use as livestock bedding and in cattle sales buildings.

Disposal of sawmill residues is a problem at the sawmills. Residues that are not used are generally disposed of in burners. But many of the small mills do not have burners and large piles of sawdust, slabs, and edgings accumulate at the mill site. The problem of disposal could be solved if future expansion of forest industries could utilize this major source of raw material. A start on the problem of disposal has been made by a new wood-chip plant that uses slabs and edgings for pulp chips. Other developments show promise of increasing the use of residues to the benefit of the sawmill.

Logging residues are left in the woods, except for small amounts salvaged for firewood. Tops are generally rough and are of little economic value at present. These tops, as well as cull and broken logs, do have a potential value as a source of chips for pulp and other uses. Also, the tops of young sawtimber trees, which are usually straight, could furnish pulpwood. Disposal of logging slash from timber sales on Federal and State lands is usually handled by the agency selling the timber. On such sales the buyer pays for disposal at the time the timber is purchased.

Residues produced by sawmills and logging operations could be an important source of raw material for a new forest industry. Ponderosa pine is an excellent species for pulp and paper, particle board, and other uses for which residues could serve as a source of raw material. Sawdust and bark could be composted to form a high-nutrient mulch or soil conditioner. An increase in use of residues for lath, fuel, baled shavings, and small cut stock from trim and strips could be the basis for an expanded industry. However, not all of the residues produced would be economically available to a new or expanded industry becuase the sawmills are too widely scattered (see fig. 1).

Eight treating plants using various wood preservatives and treating methods produced 833,000 posts, 98,000 poles, and 225,000 board feet of treated lumber annually. This represents 40 percent of their capacity. Creosote is used by two of the plants--one using the pressure process and one using the pressure and full-length thermal process. Penta (pentachlorophenol) is used in the cold-soak full-length method by three plants. Osmosalts is used by one pressure plant and osmoplastic butt treatment is used by another plant. Also, one operation produces peeled untreated poles for shipment out of the area for treatment (fig. 8). Untreated "pitch" posts from old fire-killed trees are also produced by several operators.

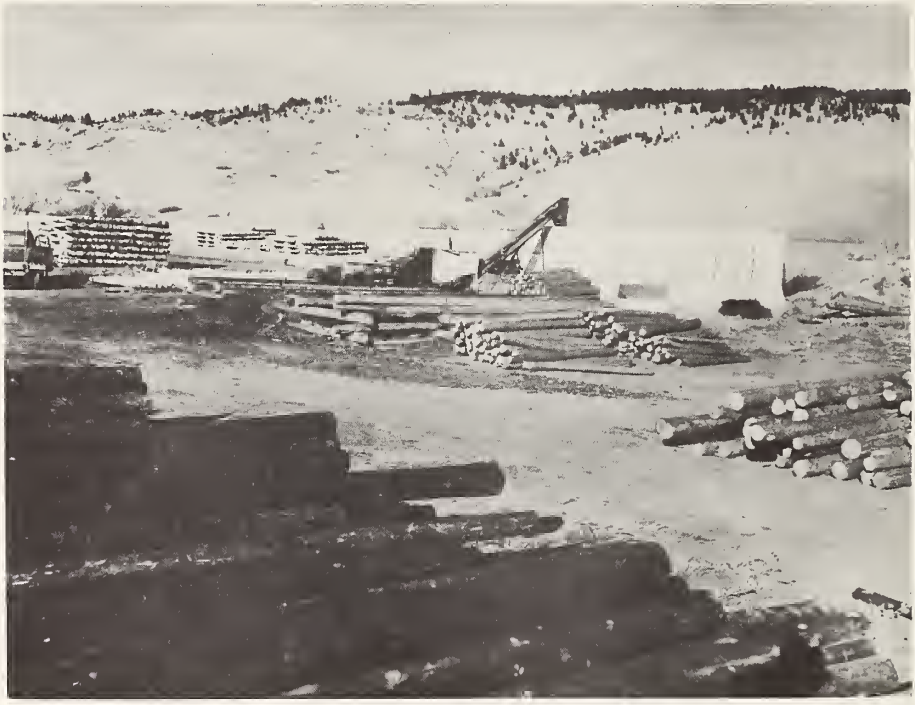

Figure 8. --Poles are peeled and seasoned in this yard before shipment to a pole-treating plant in the Midwest.

Three plants use the pressure process, while the remaining use variations of non-pressure procedures. The pressure plants follow American Wood Preservers Association (AWPA) pressure-treating procedures. The plants using the cold-soak full-length method air-dry all posts to below 30 percent moisture content and then cold soak the posts in a petroleum solution of 5 percent penta (fig. 9). Generally, soaking time of 3 to 6 hours is required in the application of the cold-soaking process. The plant using the thermal process soaks the dry or semidry posts for several hours in creosote heated to 220° F., followed by a similar soaking in a cooler solution of creosote. The osmoplastic butt treatment consists of dipping freshly peeled green posts in a heated tarlike preservative. According to the operator, the posts are then closely stacked to retard drying so that preservatives can diffuse into the green sapwood.

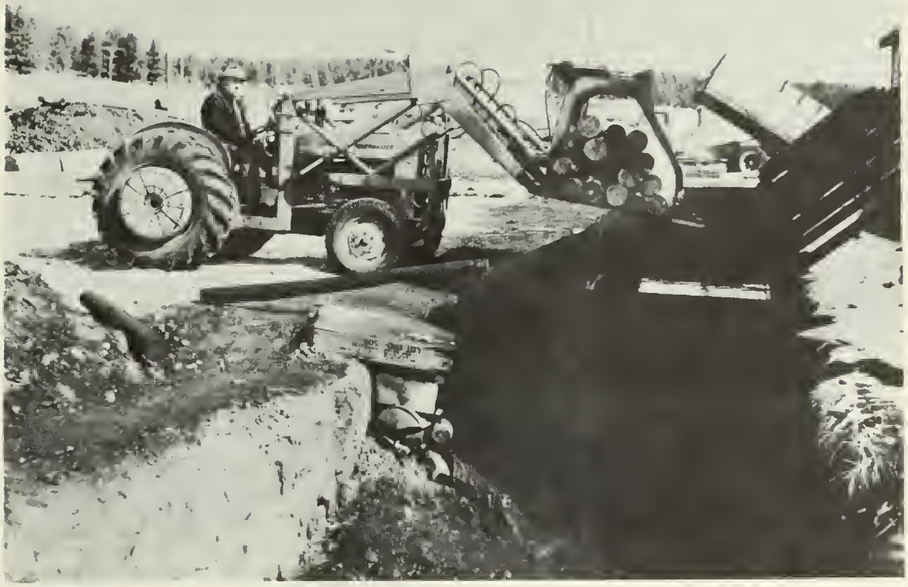

Figure 9. --Treating plant using the cold-soak method with pentachlorophenol preservative.

Generally, ponderosa pine posts and poles are cut in thinning operations on Federal and State lands. Only 25 percent are obtained from thinnings or clear-cutting operations on private land. The present post and pole industry uses about 10 percent of the total roundwood resource (120, 000 cords) estimated to be available for annual harvesting on a sustained cut.

Markets for the preservative-treated and untreated products are within about 600-700 mile radius of the Black Hills. Much of the production goes to retail lumber yards. In 1958, pressure-treated material accounted for 72 percent of the total volume going to the markets in this area. Nonpressure treated material accounted for 23 percent of the total and was divided among osmoplastic butt treatment (14 percent) and cold-soak penta (9 percent). Untreated peeled poles accounted for the remaining 5 percent. Since 1958 a plant using both pressure and the thermal process was built and will increase the amount of treated material. The volume sold as posts was twice as great as that of poles.

Post and pole logging practices are adapted to yearlong operations although sometimes a shift in locations may be necessary when snow is unusually deep. Posts are usually cut and loaded by hand directly onto trucks using temporary haul "roads" throughout the stands being thinned (fig. 10). Poles are skidded by either horses or tractors to landings at the haul roads where they are loaded on trucks by power jammer or front-end-lift tractor. Then the poles are trucked 10-20 miles to a treating plant.

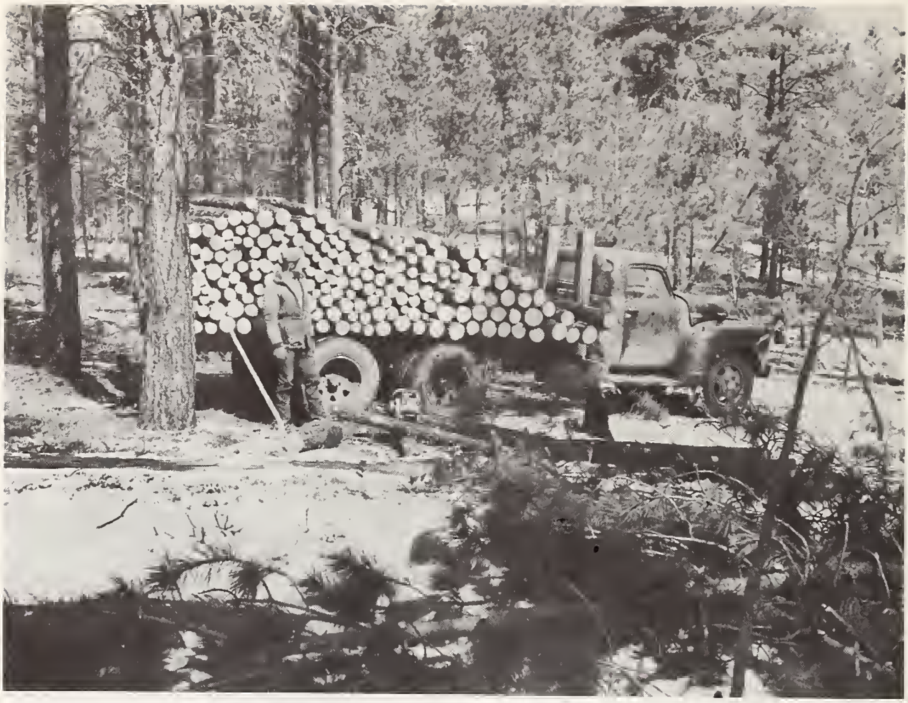

Figure 10. --A truckload of posts that were cut from thinnings on the Black Hills National Forest. Chain saws are used to fell, buck, and limb the trees.

PULPWOOD INDUSTRY

Ponderosa pine pulpwood shipments started in 1955, when 325 cords were shipped to Wisconsin pulp and paper mills. Occasional and sporadic white spruce shipments had been made previously and still continue. In 1958, favorable freight rates were put into use on multiple-car shipments. This was a major factor in increasing total production of pine pulpwood to 27,000 cords in 1959.

Ponderosa pine pulpwood is produced by operators who have contracts with pulp and paper mills in Wisconsin. These operators obtain ponderosa pine pulpwood from privately and publicly owned lands. Spruce pulpwood is also produced but only in small amounts. Usually the operators sell the spruce pulpwood through a jobber or broker instead of through contracts with pulp and paper mills. On pulpwood logging operations, powersaws are used to fell and buck trees into 100-inch lengths. The rough bolts are bunched by hand or horses and are loaded by hand or by power loaders into trucks. The bolts are then trucked 10-20 miles to one of several railroad loading points where they are unloaded and stacked (see fig. 1). Bolts are then loaded onto gondola cars by a grapple-type loader (fig. 11). A minimum of 23 cords are loaded onto each car. When several cars are assembled from the various loading points they are moved east as one shipment.

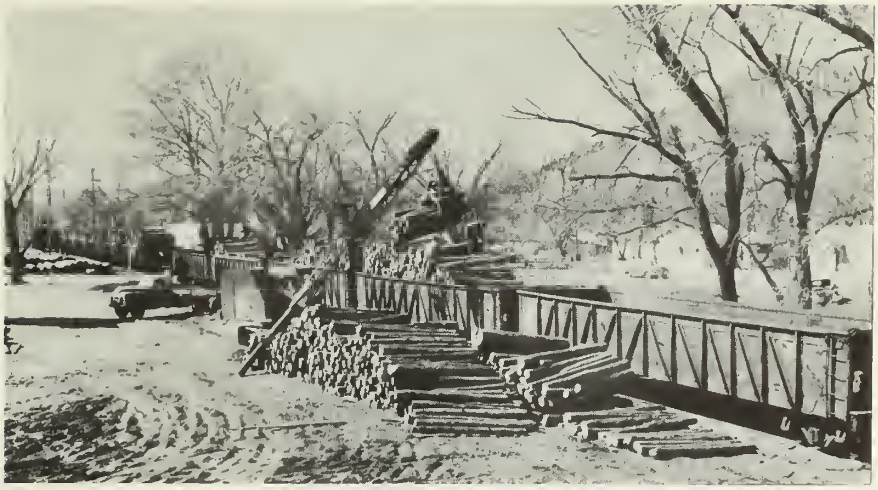

Figure 11. --Rough ponderosa pine pulpwood being loaded with a grapple-type loader.

Peeled ponderosa pine pulpwood is also produced in the woods by a portable machine peeler (fig. 12). Peeling is limited and probably only about 4 percent of the 1959 production of pine pulpwood was peeled. Peeling, however, has advantages that may cause increase in future shipments of peeled wood. One advantage is that about 20 percent more solid wood can be shipped

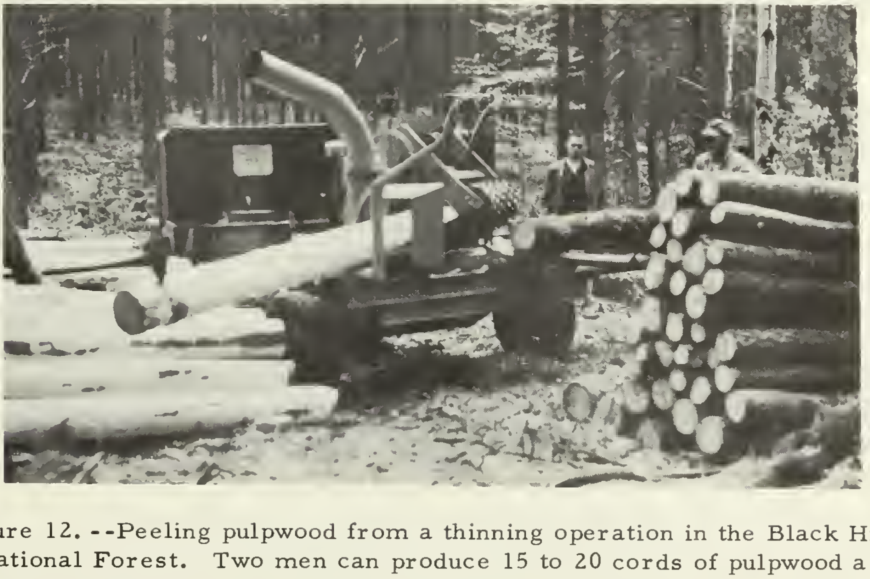

Figure 12. --Peeling pulpwood from a thinning operation in the Black Hills National Forest. Two men can produce 15 to 20 cords of pulpwood a day with this peeler.

in the same space.[5] More solid wood per car will result in lower shipping costs to the pulp and paper mills and should increase the demand for peeled wood.

Concentration of pulpwood activity so far has been along the northern and eastern flank of the Black Hills because of the location of railroad loading points (see fig. 1). The nearness of private forest land to the Chicago and North Western Railway Company and the Chicago, Milwaukee, St. Paul, and Pacific Railroad Company loading points has caused heavy cutting of pulpwood on these lands. About 75 percent of the pulpwood shipped in 1959 came from private lands. The Chicago, Burlington, and Quincy Railroad goes through the center of the Black Hills, and although currently there is little pulpwood activity along this railroad, its location should influence future pulpwood activities in this area (see fig. 1). One 10-car shipment was made in 1959 by this railroad to a pulp and paper mill in Iowa.

The Bear Lodge Mountain area of Wyoming and the northwestern part of the Black Hills is another area of potential activity but distances to a railroad are presently too great. Here, truck haul distances are 30-40 miles to the nearest railroad siding. However, there is a considerable volume of pulpwood-sized timber that could be cut in these areas.

An estimated total volume of 1.2 million cords of ponderosa pine pulpwood is available on Federal, State, and private lands in the northern Black Hills.[6] Probably another million cords would be available in the southern Black Hills and Bear Lodge Mountains. Current pulpwood operations use about 22 percent of an estimated annual allowable volume of 120,000 cords that are available in form of thinnings.

To date, all pulpwood cut on Federal lands has been from thinnings. On private lands thinnings make up about one-third to one-half of the pulpwood production. The pulpwood trees cut from thinnings range from 6.0 inches to 12.9 inches in diameter at breast height and from 19 to 77 feet in height (fig. 13). Trees of this size could be cut from thinnings throughout the Black Hills. Pulpwood from this source is of high quality and compares favorably with lodgepole pine and Lake States jack pine.[5]

SUMMARY AND CONCLUSIONS

Sawmilling is the largest forest industry in the area. There are 50 full-time and part-time mills. Circular-saw-type mills are the most common, followed by circular-saw-type with a cant sash gang resaw, circular saw with horizontal band resaw, and lastly a band head saw with a horizontal band resaw. All mills, with one exception, cut less than 10 million board feet a year and five mills cut between 5 and 10 million board feet a year.

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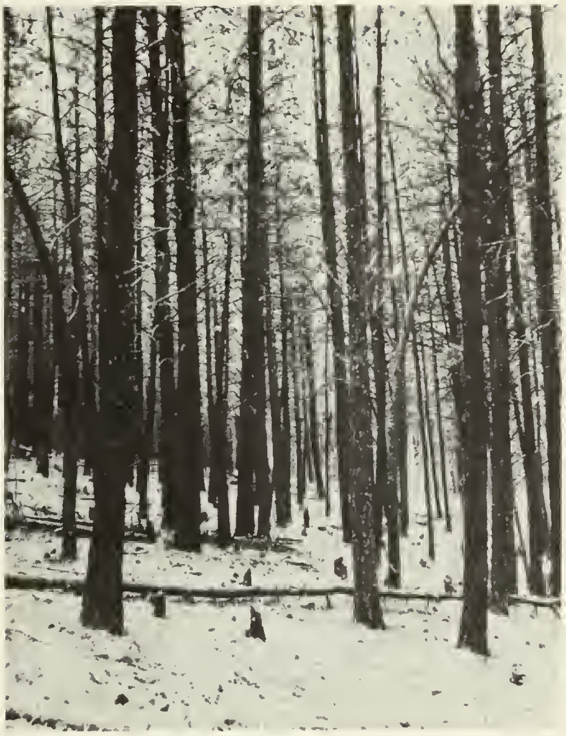
[5] Landt, E. F., and Woodfin, R. O., Jr. Pulpwood characteristics of Black Hills ponderosa pine. Tappi 42: 809-812, illus. 1959.

[6] Fechner, G. H. A survey of pulpwood resource in the northern Black Hills. U. S. Forest Serv., Rocky Mountain Forest and Range Expt. Sta. Sta. Paper 20, 21 pp., illus. 1956. [Processed.]

Figure 13. -- Ponderosa pine pulpwood stand thinned 25 years ago and now ready for thinning again.



In 1959, the production of all mills totaled 99 million feet lumber tally, which is about equal to the allowable cut. During 1959 the rated sawmill capacity was 129 million board feet. This was one of the few times in the past 36 years that the annual cut so nearly approached the allowable cut. The average for the previous period was approximately two-thirds of the allowable, although the rated sawmill capacity was consistently above this amount.

The 1959 production, which showed that the existing mills are capable of sawing the allowable volume, could lead to the conclusion that the present sawmill capacity is adequate and that there is little opportunity for additional production. Such reasoning would be premature in view of the earlier production record. Normally allowable cut controls are based on a 5- or 10-year average and not on a single year. When the annual cut has been consistently below the allowable over a period of years, such as prior to 1959, it generally follows that the allowable volume is revised upward at the time it is recalculated. Thus it appears that there is still opportunity for additional sawmill capacity in the Black Hills, particularly if combined with improved mill efficiency and quality of output. In the last several years, considerable progress has been made in the latter phases; however, with the increasing competition from other areas and materials that is in the offing, there is little justification for complacency here.

The sawmills and logging operations leave large quantities of residues. At least 90 percent of the 196, 000 tons of residues are not being used, which means that these residues represent a major wood resource that needs to be salvaged. Residues could furnish raw material to a new forest industry.

The wood-preservation industry is important in the Black Hills. The eight post and pole plants in the area treat about 833, 000 posts and 98, 000 poles annually, or about 10 percent of the roundwood available. Of this treated material, about 72 percent is produced by two plants that pressure treat. The remaining amount is produced by nonpressure methods. The treating capacity of these plants is about 30, 000 cords, or 25 percent of the roundwood currently available. Hence, there is an opportunity for expansion. However, expansion needs to be based on good market outlets.

The pulpwood industry consists of local producers who have contracts with pulp and paper mills in Wisconsin. Commercial shipments of ponderosa pine pulpwood to Wisconsin began in 1955 on a small scale. However, in 1959 pulpwood production to these mills totaled about 27, 000 cords, or about 22 percent of the roundwood available. Currently, pulpwood production is concentrated in the northern and eastern fringe of the Black Hills mainly because of the location of railroad loading points. Location of railroads close to private commercial timber lands has caused heavy cutting of pulpwood from private lands. Production from these lands in 1959 was about 75 percent of the total pulpwood production. The remainder came from U. S. Forest Service lands.

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